INDOOR AIR QUALITY

Wood-Burning Stoves Get Help from HEPA Filters

In many regions wood is seen as a cheap, renewable resource, and burning wood to heat homes is prevalent in rural and urban areas of North America and Europe.[1] A small, preliminary study suggests air purifiers equipped with high-efficiency particle air (HEPA) filters can lower the amount of indoor fine particulate matter ($PM_{2.5}$) and smoke from woodstoves, potentially reducing residents' risk of cardiovascular disease from exposure to these air pollutants.[2] "Our study is the first that I'm aware of that has shown any measurable health benefit from HEPA filtration in wood-burning communities in relatively young, healthy people," says study leader Ryan Allen, an assistant professor of health sciences at Simon Fraser University, Burnaby, British Columbia.

The researchers monitored 45 nonsmoking adults, average age 43 years, living in 25 homes in Smithers, British Columbia, where residential wood burning is common. Air purifiers costing about $150 were placed in the most active room of the house and the bedroom. The air purifiers ran for 7 days with the HEPA filter inserted and another 7 days without. The order of filter and control conditions was randomly selected for each participant, and participants were unaware of filter status.[2]

Levels of $PM_{2.5}$ and levoglucosan, a validated tracer of woodsmoke, were measured inside and outside the homes. At the end of each 7-day period, blood and urine samples were assessed for markers of inflammation and oxidative stress, and microvascular endothelial function was measured by peripheral artery tonometry.[2]

Use of the HEPA filters reduced indoor $PM_{2.5}$ concentrations by 60%, and indoor levoglucosan levels fell by 75% on average, compared with nonuse. HEPA filtration was linked to a 9.4% increase in the reactive hyperemia index (RHI), a marker of endothelial function, and a 32.6% decrease in C-reactive protein, a marker of inflammation.[2] A reduced RHI reflects an impaired blood vessel response to changes in blood flow and is an early indicator of atherosclerosis.[3] These physical changes occurred even though $PM_{2.5}$ levels were relatively low to begin with—about 11 μg/m^3 outdoors compared to the U.S. Environmental Protection Agency's annual average standard of 15 μg/m^3.[4]

Even people who don't use woodstoves themselves may benefit from HEPA filters, Allen says. "Most stoves don't put smoke into your living room directly," he explains; instead, smoke that is vented outdoors leaks back into nearby homes through cracks around doors and windows.[2]

A larger, better-controlled study is needed to confirm these findings, as well as determine any long-term health benefits of filtering indoor air, such as preventing strokes or heart attacks. Still, these initial results are promising in a world where indoor air pollution from solid fuels such as wood is a top global risk factor for disease and premature death.[5] Moreover, says Lars Barregard, a professor of occupational and environmental medicine at the University of Gothenburg, Sweden, "The use of wood for heating may become more common as the cost of other fuels rise or fossil fuels are restricted."

Carol Potera, based in Montana, has written for *EHP* since 1996. She also writes for *Microbe*, *Genetic Engineering News*, and the *American Journal of Nursing*.

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The Beat | by Erin E. Dooley

DOI to Study Chukchi Oil Spill Impact

As part of a court-ordered supplemental review of oil and gas leasing off Alaska's northwest coast, the Department of the Interior will assess potential environmental impacts of a major oil spill in the Chukchi Sea.[1] The court order resulted from a summer 2010 ruling that found the department had not properly analyzed the environmental impacts of natural gas development related to a 2008 lease sale of 2.8 million acres in the area. A revised draft of the environmental impact statement should be ready by summer 2011 and will be open for 45 days for public comment, with the final review expected by October.

PBDEs Off Wal-Mart Shelves

Beginning in June 2011 Wal-Mart will implement testing measures to verify compliance with its ban on polybrominated diphenyl ether (PBDE) flame retardants in certain products on its shelves.[2] Wal-Mart's efforts come without any federal regulation on the compounds, which only recently have begun to be regulated at the state level. Sampling during the National Health and Nutrition Examination Survey 2003–2004 revealed PBDEs in the bodies of nearly every participant tested.[3] Although health effects data are still limited for these compounds, their persistence and ubiquity have raised substantial scientific concern.

EPA Proposes Third Unregulated Contaminant Monitoring Reg

The U.S. EPA recently proposed monitoring for 30 currently unregulated drinking water contaminants, including 28 chemicals and 2 viruses.[4] The monitoring data would provide information about the prevalence of contaminants on the list to support future EPA decision making. Among the chemical

Left to right: Joseph Tart/EHP and Frank Ramspott/iStockphoto; Alexussk/Shutterstock

INNOVATIVE TECHNOLOGIES

MRI-Based Atlas of the Developing Mouse Brain Debuts

The mouse is one of the major animal models for toxicologic research, but histologic analyses are notoriously slow, taking a week or longer. A new magnetic resonance imaging (MRI)–based atlas of the developing mouse brain now provides a badly needed baseline for studies of how pollutants and genetic mutations affect brain development in mouse models.[1] The atlas traces the development and growth not only of the entire mouse brain and its constituent parts but also of its white matter and connectivity,[2] day by day, from embryonic day 12 to postnatal day 80.

The new brain atlas greatly reduces the amount of work necessary to determine the effect of either mutations or pollutants on brain development, says coauthor Susumu Mori, a professor in the Department of Radiology at the Johns Hopkins University School of Medicine. Typically, one would harvest tissue samples at different points in development and perform histologic analyses, he says, but the lack of prior knowledge of which structure is altered by a given exposure necessitates creating hundreds of histology sections—an arduous task. "Our idea," he says, "is to do three-dimensional microimaging [with MRI], which can capture the anatomy of the entire brain within a day." For that, the mouse brain atlas provides the baseline.

This baseline is ideal for determining changes in growth rates that might arise from neurotoxicities, says G. Allan Johnson, director of the Duke University Center for *in Vivo* Microscopy, who was not involved in the research. "My personal opinion," he says, "is that MR imaging—MR histology in particular—will become one of the major ways to produce quantitative measures of environmental toxicology."

The atlas quantifies the whole brain of the widely used C57BL/6 mouse, as well as the neocortex, cerebellum, hippocampus, and more than 17 other substructures, with additional substructures being added steadily. It also maps the white matter tracts and the gray matter structures. Additionally, it characterizes anatomical variability at several developmental stages.[1] Complementary use of the high-resolution technique known as diffusion tensor imaging helped boost the normally poor tissue contrast provided in immature mouse brain samples by MRI alone.

"The ability to have a three-dimensional map of the developing brain is very important for studying neurotoxicology and developmental neuroscience," says Tomás Guilarte, the Leon Hess professor of Environmental Health Sciences at Columbia University's Mailman School of Public Health, who has worked in the past with Mori. In terms of future utility, Guilarte sees the mouse brain atlas as having a breadth of applications comparable to polymerase chain reaction.

The new atlas supercedes histology-based atlases that have very limited coverage of different developmental stages, says Mark Henkelman, director of the Mouse Imaging Center at the Hospital for Sick Children in Toronto, who was not involved in the research. Henkelman says the developmental breadth of the atlas could offer critical clues to predict whether a toxicant poses a special threat to pregnant mothers or children need to avoid, or whether it's likely to affect the entire population.[3]

David C. Holzman writes on science, medicine, energy, economics, and cars from Lexington and Wellfleet, MA. His work has appeared in *Smithsonian*, *The Atlantic Monthly*, and the *Journal of the National Cancer Institute*.

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contaminants are several perfluorinated compounds, endogenous and exogenous hormones, and metals; 1,3-butadiene, a human carcinogen; and 1,2,3-trichloropropane, an animal carcinogen. The public may comment on the proposed list through 2 May 2011.

Higher Latitudes See Longer Ragweed Season

One significant cause of seasonal allergies is plants from the genus *Ambrosia*, which includes several types of ragweed. A study of ragweed pollen data from 10 U.S. and Canadian sites shows the duration of the pollen season increased by up to 27 days since 1995 at latitudes above about 41°N.[5] Papillion, Nebraska, at 41.15°N, has a season 11 days longer than in 1995, Minneapolis, Minnesota (45.00°N), has a season 16 days longer, and Saskatoon, Saskatchewan (52.07°N), has a season 27 days longer. An estimated 10% or more of the U.S. population is sensitive to ragweed pollen, and by one estimate allergies cost the United States approximately $21 billion per year.[5]

Protests against New Asbestos Plant in India

Construction on an asbestos manufacturing plant in the Indian state of Bihar has come to a halt after six months of student-led protests, according to news reports from the subcontinent.[6] Several dozen countries now ban most or all forms of asbestos,[7] and earlier this year, the Collegium Ramazzini reintroduced its call for a global ban on asbestos.[8] An estimated 125 million people are exposed to asbestos in the workplace, and thousands of deaths and new diagnoses of asbestos-related disease are reported each year.[8]

Melinda Fawver/Stockphoto

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